CLAIMS

1. A multi-channel tunable filter comprising:

a three-dimensional filter material; and

one or more gratings recorded into said three-dimensional filter material wherein each of said gratings is configured to reflect a given wavelength of a light wave and wherein each of said gratings covers a vertical portion of said three-dimensional filter material.

2. The filter of claim 1 wherein said three-dimensional filter material is a holographic material.

3. The filter of claim 2 wherein said holographic material is Lithium Niobate.

4. The filter of claim 1 wherein said three-dimensional filter material is a thin-film filter material wherein each of said gratings is configured to reflect all wavelengths of a light wave except a given wavelength.

5. The filter of claim 1 further comprising:

an optical read-head configured to move in a hitless manner between said gratings.

6. The filter of claim 5 wherein said hitless manner comprises:

moving said optical read-head in a first vertical direction with respect to a face of said three-dimensional filter material;

moving said optical read-head in a horizontal direction with respect to said face of said three-dimensional filter material; and

moving said optical read-head in a second vertical direction with respect to said face of said three-dimensional filter material.

7. The filter of claim 1 further comprising:

a fixed optical read-head wherein said filter is configured to move in a hitless manner when said fixed optical read-head reads from different gratings.

8. The filter of claim 7 wherein said hitless manner comprises:

moving said filter in a first vertical direction with respect to said optical read-head whereby said optical read-head points to said face of said three-dimensional filter material at a new position;

moving said filter in a horizontal direction with respect to said optical read-head whereby said optical read-head points to said face of said three-dimensional filter material at a new position; and

moving said filter in a second vertical direction with respect to said optical read-head whereby said optical read-head points to said face of said three-dimensional filter material at a new position.

9. The filter of claim 5 wherein said optical read-head further comprises:

a single fiber collimator and a dual fiber collimator.

10. The filter of claim 9 further comprising:

a first optical fiber attached to said dual fiber collimator; and

a second optical fiber attached to said single fiber collimator.

11. The filter of claim 5 wherein said optical read-head further comprises: two dual fiber collimators.

12. The filter of claim 11 further comprising:

a first optical fiber attached to one of said dual fiber collimators; and

a second optical fiber attached to another one of said dual fiber collimators.

13. The filter of claim 1 wherein said gratings are placed in a continuously varying spacing arrangement.

14. The filter of claim 1 wherein a multiple of said gratings are superimposed at the same location wherein multiple wavelengths are filtered.

15. A method for using a multi-channel tunable filter comprising:

moving an optical read-head in a first vertical direction with respect to a face of a three-dimensional filter material comprising one or more gratings recorded onto said three-dimensional filter material wherein each of said gratings is configured to reflect a given wavelength of a light wave and wherein each of said gratings covers a vertical portion of said three-dimensional filter material;

moving said optical read-head in a horizontal direction with respect to said face of said three-dimensional filter material; and

moving said optical read-head in a second vertical direction with respect to said face of said three-dimensional filter material.

16. The method of claim 15 wherein said three-dimensional filter material is a holographic material.

17. The method of claim 16 wherein said holographic material is Lithium Niobate.

18. The method of claim 15 wherein said three-dimensional filter material is a thin-film filter material wherein each of said gratings is configured to reflect all wavelengths of a light wave except a given wavelength.

19. The method of claim 15 wherein said optical read-head is fixed and said filter is configured to move in a hitless manner when said fixed optical read-head reads from different gratings.

20. The method of claim 19 wherein said hitless manner comprises:

moving said filter in a first vertical direction with respect to said optical read-head whereby said optical read-head points to said face of said three-dimensional filter material at a new position;

moving said filter in a horizontal direction with respect to said optical read-head whereby said optical read-head points to said face of said three-dimensional filter material at a new position; and

moving said filter in a second vertical direction with respect to optical read-head whereby said optical read-head points to said face of said three-dimensional filter material at a new position.

21. The method of claim 15 wherein said optical read-head further comprises: a single fiber collimator and a dual fiber collimator.

22. The method of claim 21 further comprising:
attaching a first optical fiber to said dual fiber collimator; and
attaching a second optical fiber to said single fiber collimator.

23. The method of claim 15 wherein said optical read-head further comprises: two dual fiber collimators.

24. The method of claim 23 further comprising:
attaching a first optical fiber to one of said dual fiber collimators; and
attaching a second optical fiber to another of said dual fiber collimators.

25. A method for recording gratings comprising:
reflecting a first beam off a first mirror stack;
reflecting a second beam off a second mirror stack; and
producing an interference between reflection of said first beam and reflection of said second beam wherein said interference etches in a recording material to form said gratings.

26. The method of claim 25 wherein said recording material is a holographic material.

27. The method of claim 26 wherein said holographic material is Lithium Niobate.

28. A method for recording gratings comprising:

using a multiple channel phase mask to direct a first order beam of said phase mask at a recording material;

using said phase mask to direct a second order beam of said phase mask at a recording material; and

producing an interference pattern between said first beam and said second beam wherein said phase mask optically induces a perturbation on the index of refraction in a recording material to form said gratings.

29. The method of claim 28 wherein said recording material is a holographic material.

30. The method of claim 29 wherein said holographic material is Lithium Niobate.

31. The method of claim 28 wherein said phase mask is used in a far field approach to form said gratings on said recording material.

32. The method of claim 28 wherein said phase mask is used in a near field approach to form said gratings on said recording material.

33. The method of claim 32 further comprises placing an interference filter between said phase mask and said recording material wherein said interference filter reflects zero order beams.

34. The method of claim 33 further comprises placing an optical diode between said phase mask and said interference filter.